

Ch. 8 Cellular Energy

Section 8.1 → How Organisms obtain Energy

I. Transformation

A. Chemical reactions + processes are constantly occurring in your cells

1. All of the cells require energy (ATP), the ability to do work

B. Laws of thermodynamics

1. 1st law = law of conservation of energy
a. energy cannot be created nor destroyed

2. Entropy, the measure of disorder, or usable energy

C. Autotrophs + heterotrophs (all organisms need energy to live)

D. Metabolism - all of the chemical reactions in a cell

1. Metabolic pathways include two major types:
→ catabolic + anabolic

a. Catabolic - release energy; large → small

b. Anabolic - use energy to build large molecules from small molecules

Dec 13-10:53 AM

2. Photosynthesis - anabolic pathway in which light energy from the sun is converted to chemical energy

3. Cell respiration - catabolic pathway in which organic molecules are broken down to release energy for cell

II ATP: the unit of cellular energy

A. ATP (Adenosine triphosphate) is the most important biological molecule that provides chemical energy

B. ATP is a nucleotide made of an adenine base, a ribose sugar, and 3 phosphate groups

1. ATP releases energy when the bond between the 2nd and 3rd phosphate groups is broken

a. $ATP \rightarrow ADP$: yields energy

Dec 13-2:39 PM

Bellringer

Cells are made of matter (chemical structures called proteins, carbs, lipids, etc)

H_2O
CHNOPS

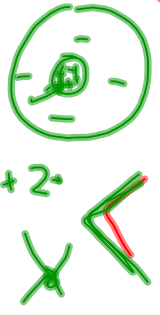
→ What is everything made of?
matter → elements → atoms

→ What are you made of?
mostly H_2O + CHNOPS (elements)

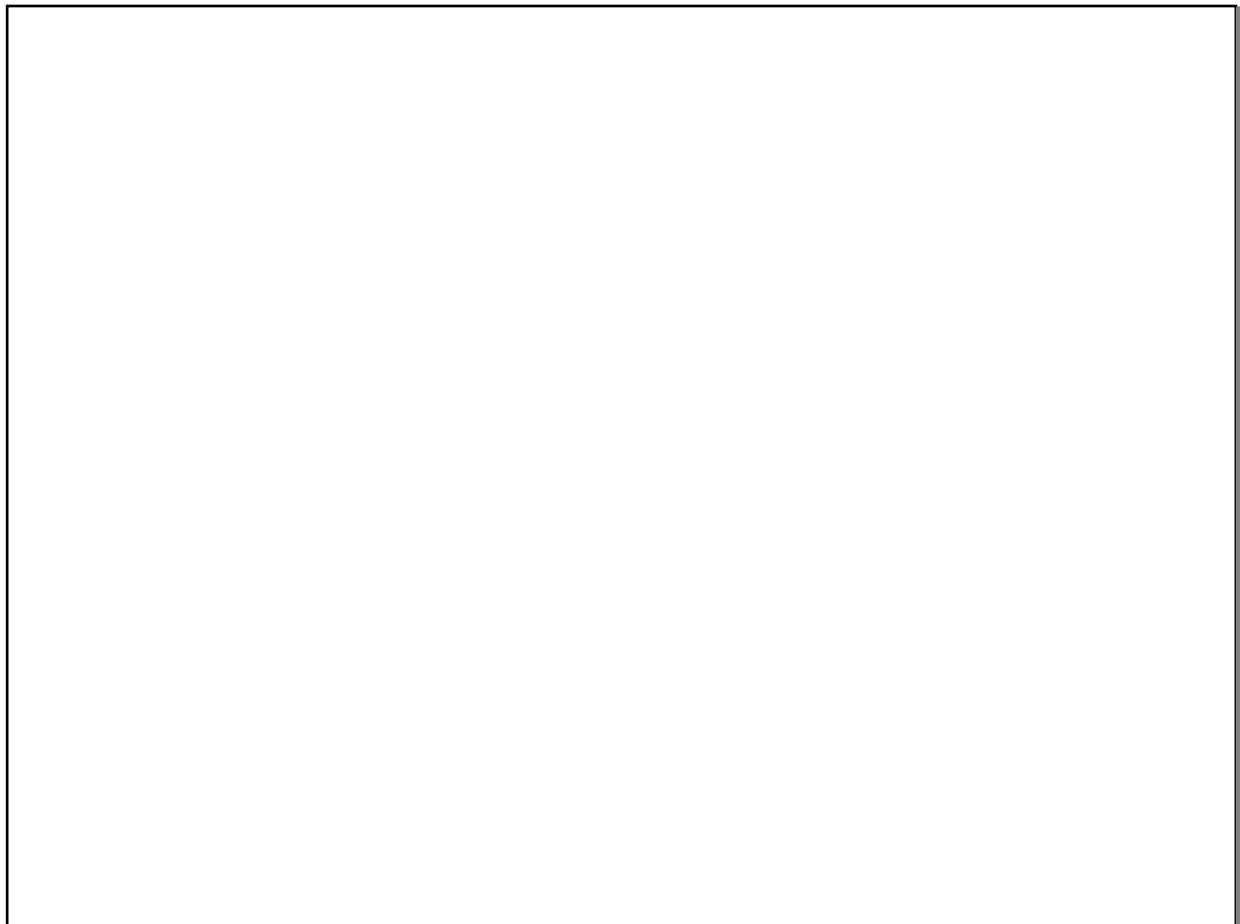
→ How do cells make energy?
Fermentation (no O_2) Cell Resp. (Animals + Plants)

→ What is a heterotroph? Photo (only Plants)
Eats other organisms... Photo Bacteria

→ What is a food web?
Complete diagram of feeding interactions in a system
MANY food chains → Food web



Jan 30-2:05 PM



Feb 13-3:08 PM

8.1 Review

Grade: 10th
Subject: Biology
Date:

Dec 13-10:53 AM

1 What does the first law of thermodynamics state?

- A entropy increases
- ☒ B energy is conserved
- C metabolism decreases
- D chemicals are produced

Dec 13-10:59 AM

2 Autotrophs that convert light energy into chemical energy are called _____.

- A heterotrophs
- B chemoautotrophs
- C photoautotrophs
- D omnivores

Dec 13-11:42 AM

3 All chemical reactions in an organism's cells are called _____.

- A chemotrophy
- B autotrophy
- C thermodynamics
- D metabolism

Dec 13-11:43 AM

4 What chemical bond in ATP releases when broken down?

- A phosphate
- B sulfur
- C oxygen
- D potassium

Dec 13-11:44 AM

5 The second law of thermodynamics states....

- A ability to do work is energy
- B spontaneous increase in disorder, entropy
- C the idea that energy cannot be created nor destroyed
- D catabolic pathways break down organic molecules

→ Entropy
↙
every chemical rxn occurs

Dec 13-11:49 AM

8.2 Photosynthesis

I. Overview of Photosynthesis

A. Equation: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

B. Occurs in two phases

1. Phase 1 (light-dependent)

a. Electron transport

2. Phase 2 (light-independent)

b. Calvin Cycle

C. Chloroplasts - disc-shaped organelles that contain two main compartments essential to photosynthesis

1. Thylakoids - flattened, sac-like membranes arranged in stacks

a. Stacks are called grana

2. Stroma - fluid-filled space that's outside the grana

D. Pigments - light absorbing, colored molecules found in thylakoid membranes of chloroplasts

1. Major light-absorbing pigments in plants = chlorophylls

E. Electron transport (1st step of photosynthesis)

* → know steps of electron transport (p. 453) Figure 10

F. Calvin Cycle (2nd phase of photosynthesis)

* → Figure 11 (pg. 455)

1. Enzyme Rubisco converts inorganic CO_2 molecules into organic molecules that can be used by the cell

a. This is known as carbon fixation

Jan 2-2:11 PM

II Alternative Pathways

A. Many plants in extreme environments have alternative photosynthesis pathways

B. C_4 plants - fix CO_2 into 4 carbon compounds instead of 3 in Calvin Cycle

1. minimizes water loss

C. CAM (Crassulacean acid metabolism) plants

1. Occurs in dry areas where access to water is limited

2. Process allows CO_2 only to enter plant at night when atmosphere is cooler and there is less humidity

a. process also minimizes water loss

3. Carbon fixation at night of organic CO_2 molecules then enter Calvin Cycle during day to minimize water loss

Jan 2-2:45 PM

8.2 Review

Grade: 10th

Subject: Biology

Date:

Dec 13-11:41 AM

1 Light absorbing colored molecules called _____ are found in chloroplasts.

A pigments

B stroma

C rubisco

D ATPs

→ chlorophyll

Jan 1-4:58 PM

2 Where do light-independent reactions occur during photosynthesis?

- A mitochondrion
- B stroma in vacuoles
- C nucleus
- D stroma in thylakoids

← chloroplasts

Jan 1-4:59 PM

3 What occurs in the second phase of photosynthesis?

- A chemiosmosis produces ATP
- B light absorbed
- C light is converted into ATP
- D glucose is made from ATP

Jan 1-5:01 PM

4 Which of these statements is true regarding chlorophyll?

- ☒ A It is not the only photosynthetic pigment
- ☐ B there is only one kind of chlorophyll
- ☐ C it is the only type of pigment in leaves
- ☐ D it is the rarest type of pigment in leaves

Jan 1-5:03 PM

5 _____ is the enzyme that converts inorganic carbon dioxide into organic carbon dioxide that can be used during the Calvin cycle.

Rubisco → performs
carbon fixation

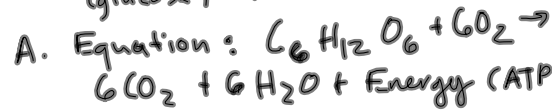
$C_6H_{12}O_6$

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Q.3 Cellular Respiration

I. Overview of Cellular Respiration

(harvest of electrons from compounds (glucose) to make ATP)



B. Two main parts: glycolysis + Aerobic respiration

1. Glycolysis = anaerobic (no O_2)

2. Krebs cycle + electron transport = aerobic resp. = (O_2 resp)

II Glycolysis

occurs in cytoplasm
A. Glucose is broken down into two molecules pyruvate (Process requires 2 ATP to begin process and provide phosphates to make two 3-carbon compounds)

Rxn = reaction
1. Phosphates are yielded when $ATP \rightarrow ADP$
2. Process produces 4 ATP molecules but only yields 2 ATP since 2 ATP is needed to start rxn.

a. NADH molecules involved with reaction carry electrons to the electron transport chain

Jan 1-4:59 PM

III Kreb's cycle (or TCA or Citric acid cycle)

→ this occurs in the mitochondria

A. Process is the conversion of the two pyruvate from glycolysis acetyl CoA that cycles through a series of chemical rxns to make (yield) energy

B. Process yields $6CO_2$, 2 ATP, 8 NADH, and 2 $FADH_2$

→ see Figure 15 p. 463

IV Electron transport (final step of cell resp.)

A. Process produces energy by using high-energy electrons and hydrogen ions to power the conversion of $ADP \rightarrow ATP$

B. Process yields 32 ATP

C. Process occurs in mitochondrial membrane
→ Figure 17 p. 467

V Prokaryotic cellular respiration

A. Process does not require pyruvate to travel to mitochondria, requiring less energy input

1. Prokaryotic cell resp yields 38 ATP

VI Anaerobic respiration (no O_2)

A. Two main types: lactic acid + alcohol fermentation

B. Follows glycolysis

→ see Figure 18

VII Photosynthesis + Cell Respiration

A. Products of photosynthesis = O_2 + glucose which are reactants for cell resp.

B. Products of cell resp. = CO_2 + H_2O which are the reactants for photosynthesis

Jan 7-2:46 PM

8.3 Review

Grade: 10th
Subject: Biology
Date:

Jan 7-9:37 AM

1 In lactic acid fermentation, _____ is converted into lactic acid.

- A alcohol
- B pyruvate
- C citric acid
- D sunlight

Jan 7-9:45 AM

2 What cellular process actually produces most of the ATP?

- A absorption of light
- B Krebs cycle
- C fermentation
- D electron transport

Jan 7-9:46 AM

3 What anaerobic process occurs after glycolysis?

- A electron transport
- B Krebs cycle
- C fermentation
- D prokaryotic respiration

Jan 7-9:47 AM

4 Glycolysis is a(n) _____ process in the first stage of photosynthesis.

- A aerobic
- B anaerobic**
- C non-metabolic
- D non-energy

Jan 7-9:48 AM

5 What do cells store and release as the main source of chemical energy?

- A ATP**
- B ADP
- C NADP+
- D NADPH

Jan 7-9:51 AM

Chapter 8 Review

Grade: 10th
Subject: Biology
Date:

Jan 7-9:37 AM

1 ^{ATP} ~~Metabolism~~ is the energy currency of the cell.

True

False

Jan 8-3:44 PM

2 The study of the flow and transformation of energy is called thermodynamics.

True
False

Jan 8-3:48 PM

3 Chemical reactions that convert energy within a cell are referred to as metabolism.

True
False

Jan 8-3:49 PM

4 Which is not a characteristic of energy?

- A cannot be created nor destroyed
- B is the capacity to do work
- C exists in forms such as chemical, light, and mechanical
- ☒ D changes spontaneously from disorder to order

order → disorder

Entropy

Jan 8-3:51 PM

5 Which organism depends on an external source of organic compounds?

- A autotroph
- ☒ B heterotroph
- C chemoautotroph
- D photoautotroph

Jan 8-3:51 PM

6 What do cells store and release as the main source of chemical energy?

- A ATP
- B ADP
- C NADP+
- D NADPH

Jan 8-3:54 PM

7 The location of the light reactions during photosynthesis is the thylakoid.

- True
- False

Jan 8-3:54 PM

8 A colored molecule that absorbs light is a _____.

pigment

Jan 8-4:08 PM

9 A process in which energy is stored in organic molecule is the Calvin cycle.

True

False

Jan 8-4:08 PM

10 What waste product of photosynthesis is released to the environment?

- A carbon dioxide
- B water
- C oxygen
- D ammonia

Jan 8-4:09 PM

11 Which is the internal membrane of the chloroplast that is organized into flattened membranous sacs?

- A thylakoids
- B mitochondria
- C theca
- D stroma

Jan 8-4:10 PM

12 Which supplies energy used to synthesize carbohydrates during the Calvin cycle?

- A CO_2 and ATP
- ☒ B ATP and NADPH
- C NADPH and H_2O
- D H_2O and O_2

Jan 8-4:12 PM

13 Pyruvate is broken down into carbon dioxide during the Krebs cycle.

Jan 8-4:20 PM

14 Anaerobic processes occur in the absence of oxygen.

Jan 8-4:21 PM

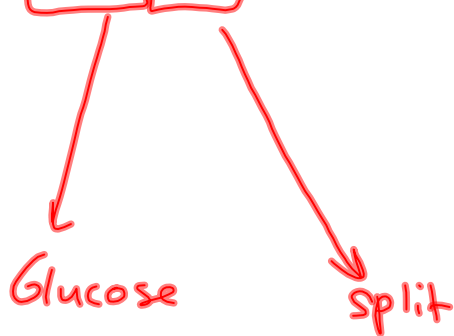
15 The two main types of fermentation are ~~pyruvate~~ ^{lactic acid} fermentation and alcohol fermentation.

True

False

Jan 8-4:22 PM

16 Glucose is broken down during the process of glycolysis.



"splitting of glucose" = Glycolysis

Jan 8-4:23 PM

17 Which cell organelle is the site of cellular respiration?

- A Golgi apparatus
- ☒ B mitochondrion
- C nucleus
- D endoplasmic reticulum

Jan 8-4:24 PM

18 Which is not a stage of cellular respiration?

- A glycolysis
- B Krebs cycle
- C electron transport chain
- ☒ D lactic acid fermentation

Jan 8-4:26 PM

19 What is produced when the electrons leave the electron transport chain in cellular respiration and bind to the final electron acceptor for the chain?

- A H_2O
- ☒ B O_2
- C CO_2
- D $NADPH$

Jan 8-4:30 PM

20 Which step occurs during the Calvin cycle?

- A formation of ATP
- ☒ B formation of six-carbon sugars
- C release of oxygen gas
- D transport of electrons by NADP+

Jan 8-4:34 PM

21 Which energy transformation can occur only in autotrophs?

- A chemical energy into mechanical energy
- B electrical energy into thermal energy
- ☒ C light energy into chemical energy
- D mechanical energy into thermal energy

Jan 8-4:35 PM

22 A stack of thylakoids is a granum.

True

False

Jan 8-4:37 PM

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